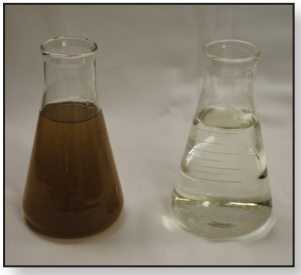
Roanoke Regional Water Pollution Control Plant

Treating the Valley's Wastewater

The Treatment Process



The Roanoke Regional Water Pollution Control Plant provides tertiary treatment for around 37-million gallons of sanitary sewer a day from all jurisdictions in the Roanoke Valley. A drop of water entering the Plant takes approximately 24 hours to move through all levels of the liquid treatment process. More than 3,000 lab tests are conducted every month to verify that the liquid treatment process is meeting or exceeding some of the most stringent water quality standards of any plant in Virginia.

Headworks

Before the wastewater begins the series of treatment processes, the Archimedes screw pumps lift the flow 33.7 feet to begin preliminary treatment. Center flow band screens remove objects larger than 1/4-inch which are disposed of in the landfill. Each of the 114-inch diameter spiral screw pumps have the capacity to pump 40mgd.

Primaries

Fiberglass bars, known as flights, skim across the surface of the water in the settling tanks to remove the floating scum before turning downward to scrape away the material that has settled at the bottom of the tank. Primary treatment removes about 40% of the suspended solids in the wastewater.

Aeration

After leaving the primary clarifiers, wastewater travels to one of 16 aeration basins where air is blown into the flow to raise the dissolved oxygen levels, sustaining the microorganisms that consume the organic material (carbonaceous BOD) in the wastewater. This process takes 4-6 hours; all the while microorganisms are feeding on and removing the organic matter carried in the flow.

Secondary Treatment

Without a food source in the settling basins, the organism's reproduction slows, bacteria lose their flagella and slime accumulates outside the cell walls. The organisms begin to stick together and form floc large enough to settle. The settled floc is returned to the plentiful food supply in the aeration basins. Clarified water flows to coagulation tanks.

Coagulation

By this step of the treatment process, only very small particles remain. Chemicals, such as iron salts (ferric chloride) and polymers are added to make the tiny particles bind together in masses called floc. The floc is large enough to settle to the bottom of the coagulation tanks or be caught in the filtration process.

Filtration

The flow is passed through one of ten deep bed monomedia filters as the final purification process before the flow goes to the chlorine chamber for disinfection. Tertiary treatment includes filtration and advanced nitrogen and phosphorus removal.

Disinfection

Pathogens are removed throughout the treatment process, but the final step of chlorination guarantees the quality and safety of the water discharged into the Roanoke River. After contact with sodium hypochlorite for 30 minutes to ensure that all the pathogens are killed, the water is then treated with sodium bisulfite to remove all chlorine. Four 300hp screw pumps can be used to pump the effluent when river stages are elevated and gravity feeding the flow into the river is not effective.

Solids Treatment

Digestion

Sludge from primary and secondary clarifiers is heated and mixed to promote the anaerobic consumption of organic material by bacteria contained within the tanks. First, acid forming bacteria use the organic material energy supply to produce organic acids and carbon dioxide. A second group of bacteria, the gas formers, break down the organic acids to make methane and carbon dioxide gas.

Biosolid Lagoons

After the digestion is finished, the sludge is pumped to one of five lagoons providing 23 pond acres of storage to complete treatment. Both anaerobic and aerobic bacteria consume any remaining organic matter, and solids settle to the bottom of the ponds.

Land Application

After about a year, the fully processed material is applied to farms as fertilizer at no cost to the farmers. The application process and quality of the biosolids is held to strict standards set forth and enforced by the DEQ.

Providing Extra Capacity

The Biological Aerated Filter (BAF) has been modified to provide treatment for an additional 30mgd from the equalization basins which enhances the overall peak treatment capacity of the facility and extends the storage capacity during wet weather events. Although the plant is rated for 55mgd average treatment, wet weather events can increase the volume of flow received at the plant. On a peak day, over 146 million gallons of flow has been successfully treated.

Biogas to Renewable Natural Gas

The Western Virginia Water Authority (Authority) and Roanoke Gas Company (Roanoke Gas) are partnering to produce commercial quality renewable natural gas, or RNG, from bio gas produced at the Roanoke Regional Water Pollution Control Plant. This RNG product, the first of its kind in the Commonwealth, necessitated construction of a digester gas conditioning system and interconnect facility at the Water Pollution Control Plant. This new supply source provides enough natural gas to heat 500 homes on a cold, winter day.

Utilizing an advanced membrane separation system, raw digester gas is refined to commercial quality natural gas for use within the greater Roanoke community, offering the protection of the environment and complete recycling of waste at a level only imagined a decade ago.

Biogas, also known as digester gas in wastewater treatment, a mixture of methane (63%) and carbon dioxide (37%), is produced as a by-product of the anaerobic digestion treatment process as bacteria consume the organic solids that are removed earlier in the wastewater treatment process. Initial treatment of the biogas includes pretreatment, which removes hydrogen sulfide, moisture, siloxanes, and VOCs, compression and CO2 removal. Compression is required to boost the digester gas to pipeline pressure at the interconnect facility. Membrane filters remove the carbon dioxide (CO2).

In the design of this particular installation, a third stage of membranes, located inside the digester gas conditioning system, further treat all the produced tail gas and recover residual methane. The digester gas conditioning system has the ability to create pipeline quality RNG at a design flow of 550,000 cubic feet per day (cfd).

WESTERN VIRGINIA
WATER AUTHORITY

Roanoke Regional Water Pollution Control Plant
1502 Brownlee Avenue • Roanoke, VA 24014
540.853.5700 • www.westernvawater.org
Mike McEvoy, Executive Director
Scott Shirley, Chief Operating Officer - Water Quality